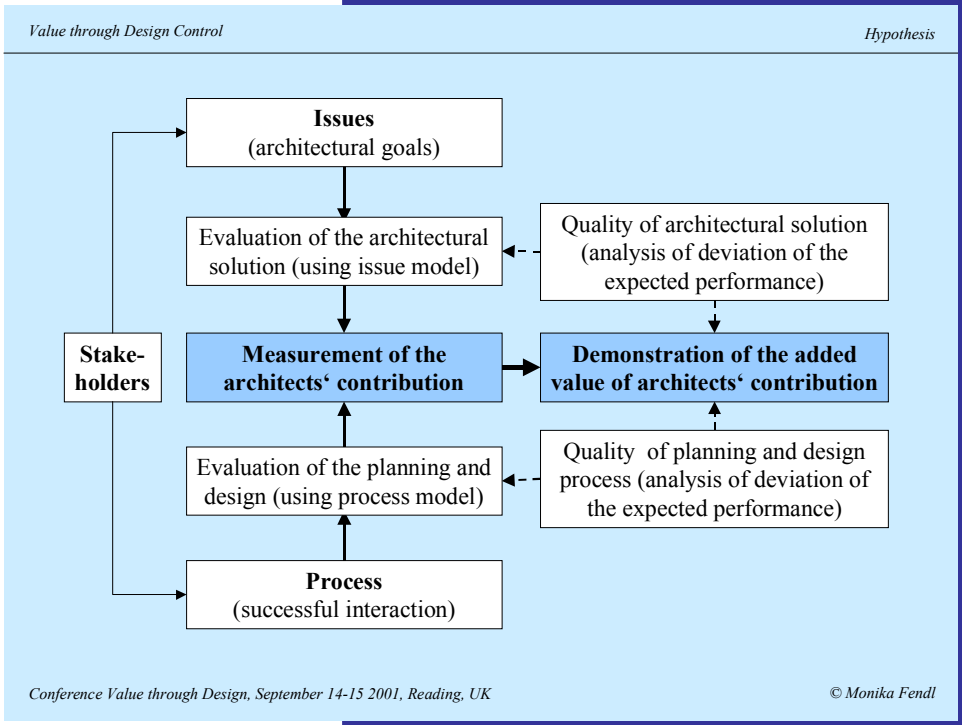
TECHNISCHE UNIVERSITÄT DRESDEN

Architektur Information TU Dresden

34 (2001)

SCHRIFTENREIHE DER FAKULTÄT ARCHITEKTUR

Value Through Design Control



A Theoretical Approach Towards a Strategy for a Controlled Planning and Design Process. Paper prepared for the Conference Value Through Design held on The University of Reading Campus on September 14-15 2001. Organised by CIB W96 Architectural Management & The Design Research Society & Department of Construction Management & Engineering, The University of Reading, England, UK.

Monika Fendl
Edited by Heinzpeter Schmieg

Architekturinformation TU Dresden – Schriftenreihe der Fakultät Architektur – Nr. 34 (2001)

Value Through Design Control

**A Theoretical Approach Towards a Strategy
for a Controlled Planning and Design Process.
Paper prepared for the Conference Value Through Design
held on The University of Reading Campus on September 14-15 2001.
Organised by CIB W96 Architectural Management
& The Design Research Society
& Department of Construction Management & Engineering,
The University of Reading, England, UK.**

by
Monika Fendl[**]

Edited by
Heinzpeter Schmieg[*]

This publication is also available online:
http://hsss.slub-dresden.de/hsss/servlet/hsss.urlmapping.MappingServlet?id=998987005203-3837

[*] Prof. Dr.-Ing. Heinzpeter Schmieg is the head of the DFG-project „Planning and Design Methods in Architecture“ and head of the Chair for Architectural Design of Social Facilities and Healthcare Buildings at Technische Universität Dresden [Dresden University of Technology], Germany.

[**] Dipl.-Ing. Monika Fendl is the DFG-project researcher and scientific assistant at the Chair of Professor Schmieg. Address: Technische Universität Dresden, Fakultät Architektur, Professur für Sozial- und Gesundheitsbauten, 01062 Dresden, Germany. [Contact: mailto:Monika.Fendl@web.de / Website: http://www.tu-dresden.de/arige/sozialb/].

Table of Contents

Value through Design Control

by Monika Fendl

Abstract

Accepted Abstract for the Conference Value through Design *(with little corrections)*

Framework

The paper as an component of an extensive research project on design methods focuses on the question how architects could develop systematically goal-oriented architectural solutions (including innovative solutions) in the complex field of social and healthcare buildings.

Questions

Within this framework, the paper, a component of the whole research project, is looking at two fundamental questions in terms of the indispensability of the contribution of architects during the planning and design process for such complicated design tasks:

1. Are there any techniques for measuring the added value contributed by architects?

2. How can architects demonstrate / communicate the added value of their contribution?

Hypotheses

1. The added value of the architects' contribution can be measured either through evaluation of the architectural solution or of the planning / design process.

2. Architects can demonstrate / communicate the added value of their contribution either through the quality of the architectural solution or the successful procedure that is therefore satisfying that architects, engineers, clients, users, etc. are included.

Starting basis

The starting basis for this paper consists of two models concerning the work of the architect developed by the author:

1. The first model, the "issue model", explains the multidisciplinary issues architects have to take into account while planning and designing. This model is a basis to measure the quality of the architectural solution.

2. The second model, the "process model", describes - in accordance with the definition of the architects' area of responsibility - the terms planning and design and their process. This model is a basis to evaluate the process.

Description of issue model and the process model in terms of design control

The "issue model" provides a structure to identify all important areas of interest for planning and designing. This model helps to gather, store, manage, retrieve and apply information as well as to use it in order to evaluate the architectural solution.

The "process model" provides a structure for the process (steps) as well as additional components. These additional components are to be taken into consideration while proceeding the steps.

The most important additional component of the "process model" is "design control". While plenty of other well-known models of the planning / design process intend to evaluated the architectural solution cyclically or even (only) after its occupancy, this model proposes to control each step and therefore the whole process. Therefore, it is possible to compare continuously the goals of each step and the achieved results of each step. That allows to influence the future proceeding "step by step". In addition, architects can control the whole planning and design process and can pass this information about the progress to the client. This will contribute to a clear and satisfying collaboration and interaction.

The last stage of design control is called Pre-Occupancy-Evaluation (PreOE) and represents the last chance to identify mistakes before realisation is started. The added value of the design can be shown through an analysis of deviation of the expected performance.

Example

With this procedure - using an "issue model" as well as a "process model" which focuses on the control of architectural solution and procedure – a design project for a department for the treatment of cancer patients was developed. This example provides - even within the strict rules mentioned above - an innovative and world-wide unique architectural approach which is to be described and explained very briefly in the paper.

Conclusion

Continuous control from the beginning of planning and designing to the finishing of the plan / design is a must to achieve goal-oriented architectural solutions and a successful procedure. High quality of architectural solutions can be achieved through design control.

Outlook

In the full paper version the issue model and the process model as well as the last important stage of control - the PreOE - are explained in detail. In addition, methods and techniques to measure the quality of architectural solutions and the quality of the process are presented.

Monika Fendl, 2nd April 2001

Remark

The announced chapter on Pre-OE is contrary to the abstract not part of the following paper because it would have been too extensive. I would like to direct you toward the forthcoming publication on the research project mentioned above which includes a chapter on PreOE. In addition, I abstained from presenting in detail the example of a strategic procedure to plan and design a hospital as well as the exemplary architectural solution (design project) for that hospital because of another forthcoming publication. If you are interested in these publications, please do not hesitate to contact me.

Monika Fendl, 1st June 2001

Foreword

It is obvious that the paper does not have any footnotes. The reason for that is that the paper is a result of my own thoughts on the question how architects could measure and demonstrate the added value of their contribution within the planning / design process. My thoughts have resulted in a theoretical approach to answer this question. This approach is based on my current research which has been ongoing for two years is still in progress. All ideas are developed by myself and therefore there are no footnotes but I would like to direct you toward theses referneces:

The first one is a publication on the architectural milieu and its influence on patients treated with huge medical equipment (written in German):

Fendl, Monika: Die bauliche Hülle von medizinischen Großgeräten und deren Bedeutung für ein therapeutisches Milieu, in: Architekturinformation TU Dresden, Schriftenreihe der Fakultät Architektur, no. 31, 1999
(online: http://www.tu-dresden.de/arige/sozialb/forschung/fendl01.pdf)

The second one is the proposal for the research project mentioned above that is now granted by the Deutsche Forschungsgemeinschaft (German Research Council) (published in English and German):

Fendl, Monika; Schmieg, Heinzpeter: Planning and Design Methods in Architecture. Analysis and further development illustrated by the example of social and healthcare buildings. Research design of DFG-project SCHM 1513/1-1. Planungs- und Entwurfsmethoden in der Architektur. Analyse und Weiterentwicklung, dargestellt an einem Beispiel aus dem Bereich Bauten des Sozial- und Gesundheitswesens. Forschungsdesign des DFG-Projekts SCHM 1513/1-1, (bilingual/zweisprachig) in: Architekturinformation TU Dresden, Schriftenreihe der Fakultät Architektur, Nr. 32, 2000
(online: http://www.tu-dresden.de/arige/sozialb/forschung/fendl02.pdf)

The final publication on the research project will be available in 2002. There will also be mentioned some aspects of this paper.

This paper was specifically prepared for this conference in Reading and was written during my research stay in the USA. For many discussions and plenty of new impulses, I would like to thank especially – in the chronological order of my visits:

Thomas J. Allen, Sloan School of Management, Massachusetts Institute of Technology, Cambridge, Massachusetts, USA

Gunter Henn, Technische Universität Dresden, Deutschland; Henn Architekten, Munich, Berlin, Dresden, Germany

William Lyman Porter, Department of Architecture, Massachusetts Institute of Technology, Cambridge, Massachusetts, USA

Ömer Akin, Carnegie Mellon University, Pittsburgh, USA

Heike Goeller, Reinhart Butter, Department of Industrial, Interior, and Visual Communication Design, The Ohio State University, Columbus, USA

Liz Sanders, Company Sonic Rim, Columbus, USA

Wolfgang F. E. Preiser, DAAP, University of Cincinnati, Cincinnati, USA

Edward Arens, Galen Cranz, University of California in Berkeley, California, USA

Anne-Cathrin Schulz, Lothar Maier, George Tingwald, Company SOM, San Francisco, USA

Hans-Christoph Haenlein, **Banny Banerjee, Barry Katz**, Company IDEO, San Francisco, USA

Bill Rostenburg, Joyce Polhamus, Company SmithGroup, San Francisco, USA

For reading and correcting the paper before submission I would like to thank very much:

Catharina Kriegbaum, Trumpf GmbH + Co. KG, Ditzingen, Germany

Rachael Luck, The Research Group for Inclusive Environments, The University of Reading, Reading, UK

Monika Fendl

Terms used the first time are in **bold** letters, terms used later on are *cursive.*

Framework

The paper is based on an extensive research project on design methods: The title of the project is "Fundamentals of Planning and Design Methods in Architecture – Analysis and Further Development of Planning and Design Methods Illustrated by the Example of Complex Planning and Design Tasks Especially in the Field of Social and Healthcare Buildings". It focuses on the question how architects could develop systematically goal-oriented architectural solutions (including innovative solutions) for complex planning and design tasks.

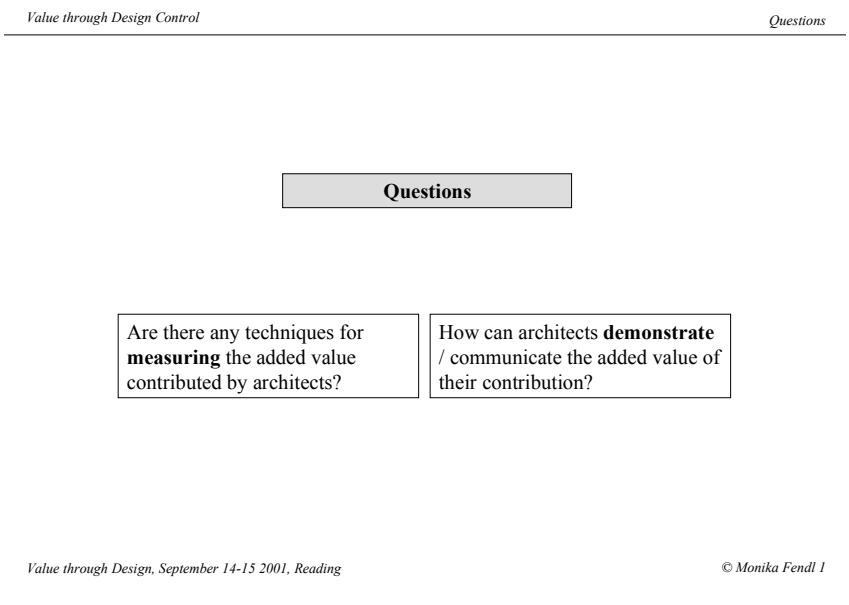
The overall aim of the research project is to develop a method supporting the process of architectural **planning and designing** that is to be defined as a procedure to develop architecture. **"Architecture"** is an environment intentionally formed through people using an – intelligent – analytical and creative way and is therefore the result of a procedure striving for or even achieving defined goals, such as the physical and psychological well-being of the users as well as formal, constructive, technical, economical, and ecological issues.

Questions

Within this framework, the paper, a component of the whole research project, is looking at two fundamental questions in terms of the indispensability of the added value of the contribution of architects during the planning and design process for such complex design tasks:

1. Are there any techniques for **measuring** the added value contributed by architects?

2. How can architects **demonstrate** / communicate the added value of their contribution?



Hypotheses

Measurement of the added value

The added value of the architects' contribution can be **measured** either through **evaluation of the architectural solution** or **of the planning / design process**.

Demonstration / communication of the added value

Architects can **demonstrate** / communicate the added value of their contribution either through **the quality of the architectural solution** or **the successful interaction** that is therefore satisfying that architects, engineers, other contributors, clients, users, etc. are included. The quality of the solution and of the interaction can be measured by using the method **"analysis of deviation"**. The idea is to find out whether the people involved are content with the architectural solution and also with the interaction during the process.

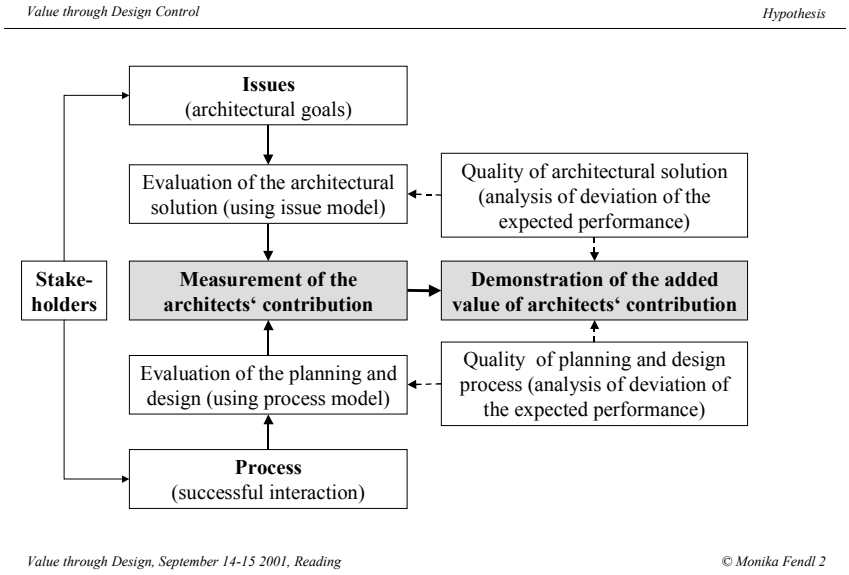
General theoretical approach

The following chart shows the general theoretical approach to find answers to the posed questions. First of all, planning / designing is influenced and done by people involved, so-called **stakeholders**.

These stakeholders influence the planning / design **issues** through formulating architectural goals. These goals cover architectural aspects as well as non-architectural ones. They are used later on for a valid evaluation of the architectural solution and consequently of the quality of the architecture. To visualise the wide range of issues, an **issue model** is developed.

In addition, people have an effect on the **process** through leading, attending, observing, or even ignoring the planning / design process. This process is illustrated by a **process model.** This model is to be used for evaluating this **interactive process** and is therefore looking at the quality of the planning and design process.

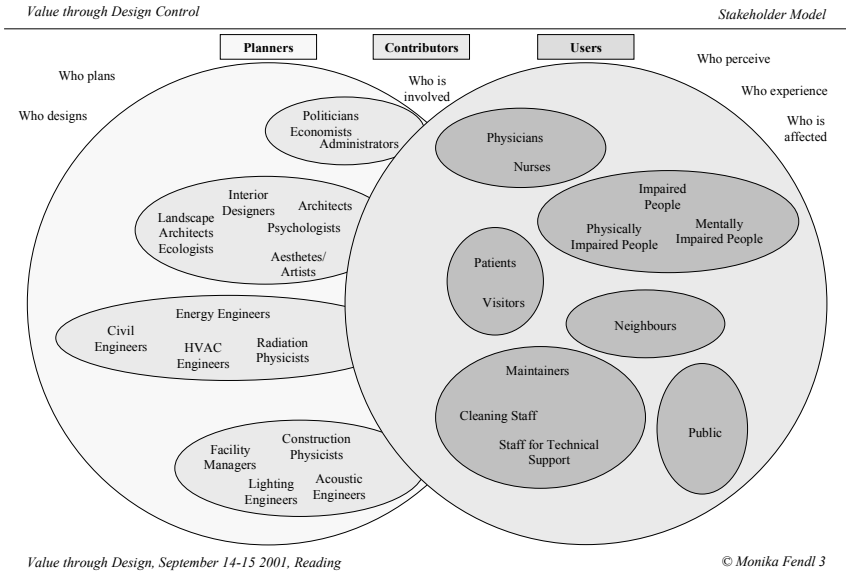
With these two approaches it is possible to evaluate on the one hand the quality of the architectural solution and on the other hand of the planning and design process. It is therefore possible to answer the two questions in terms of **measurement** and **demonstration** (see centre of the graphic) using these models combined with an **analysis of deviation of the expected performance** of the architectural solution and the planning / design process.



Starting basis

Stakeholder model

The starting basis for this paper are the two models mentioned above and the **stakeholder model** which is not meant to define groups precisely, but to illustrate that people could belong to different groups (sets) within the planning / design process. This model includes people having any kind of demands on or are affected by the architectural solution or the interactive process.



Architecture is made *by* people and *for* people. There are

- people who are the planners and designer themselves, called **planners**,
- people who are **users**, in other words, who are affected by architecture but – possibly – without having a direct influence on it, **non-contributors**, e.g., and
- people who are involved in planning / designing, called **contributors**.

The investigation turned out that there are not three sets of people, but only two, the *planners* and the *users*. The intersection set between planners and users are called *contributors* and are either part of the set of planners or of the group of users. Although it is important to include into the process also the non-contributors e.g. for gathering information, the paper focuses on the intersection group of contributors because they are aware of their ideas and are consequently suitable to be interviewed later on.

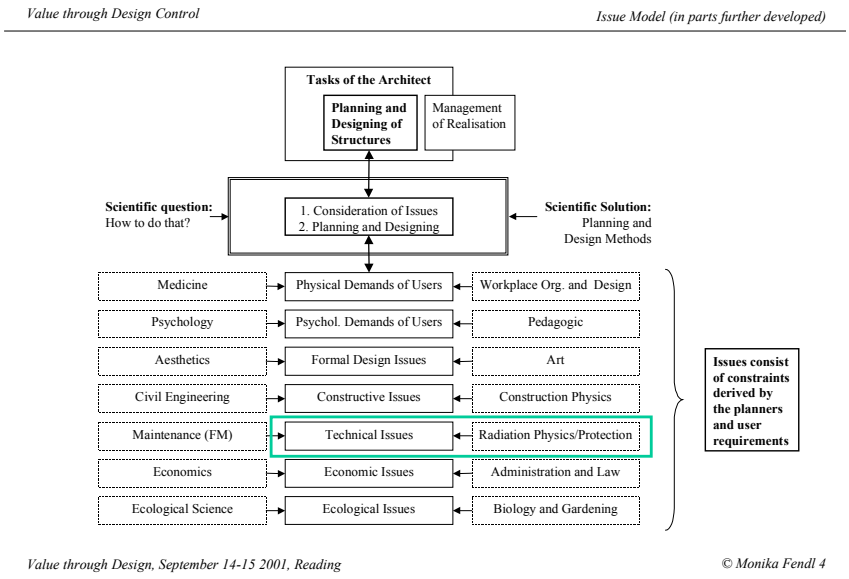
Description of issue model and the process model in terms of design control

Issue model

The *issue model* provides a structure to identify all important areas of interest for planning and designing. This model helps to gather, store, manage, retrieve, and apply information as well as to use it for evaluation of the architectural solution.

The *issue model*, visualises the **multidisciplinary issues** architects have to take into account when planning / designing simple and complex buildings. The column in the middle shows the general requirements architects have to take into account while planning and designing. The column on the left is added as an example and tells more about the people (stakeholders) and the subjects that could contribute to the planning / design process. The right column gives further examples of subjects which should be asked for their support. The model consists of given **constraints,** as e.g. the site or static aspects, and of **requirements** formulated by all stakeholders, especially by the users. These central issues are called **main issues**.

The *issue model* is to be seen three-dimensional. Each column shows subjects of interest (constraints and requirements) and is to be extended by additional requirements in the same field. "Behind" each requirement one can identify stakeholders who are able to provide information about the requirements. Any space or room in the building to be planned has be investigated in terms of each issue mentioned in the middle column and has to be further developed in terms of the subjects and the stakeholders involved. Of course, in the left column there will be listed much more than only one single issue. There will be plenty of issues, e.g. in terms of the technical requirements in hospitals. Later on, an example will be given to show how the further development of the *issue model* could look like.

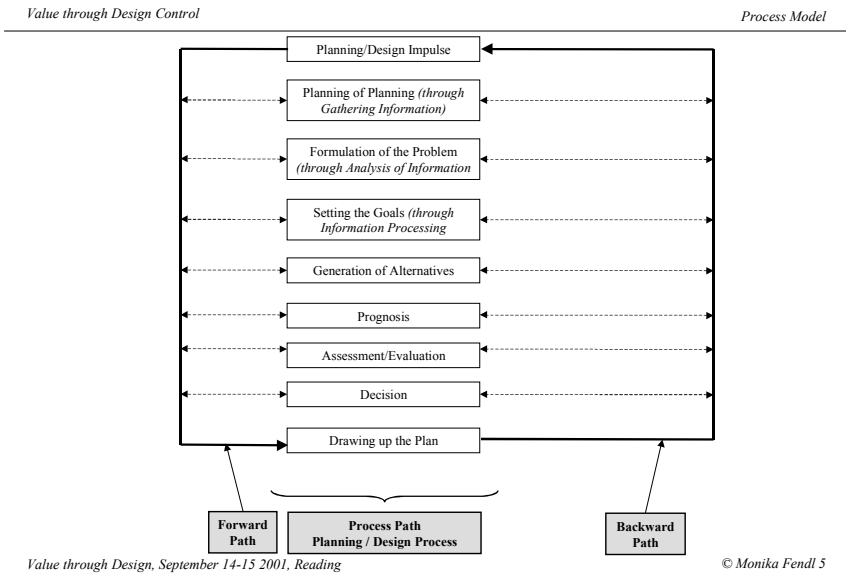


Actually, this model is a basis to measure the **quality of the architectural solution**.

Process model

The *process model* provides a structure for the process (steps) as well as for important additional components. These additional components are to be taken into consideration while proceeding the steps as we will see later on.

The *process model* describes – in accordance with the definition of the architects' area of responsibility – the terms planning / design and its process. The column in the middle describes the steps – it is called **the process path** – that is recommended to be followed by architects. The big arrow on the left – **the forward path** – shows the general way of proceeding (feed forward). The arrow on the right – **the backward path** – shows that it might be necessary to go back to previous steps (feed back). To not formulate the rule that each step has to be done, there are small arrows from the forward and the backward path to the steps to show that any user of the model is allowed to leave the path and follow other paths forwards or backwards at any time. By visualising the general approach of the process of planning / designing, any stakeholders, planners, contributors, or users, are able to know how the interactive procedure is to be done. Consequently, it is possible for them to evaluate if every important issue is considered and every step of the interactive process is done. Therefore, they are able to add their contribution or to ask planners to think about one special issue in more detail, if necessary. Therefore, this model is a basis to evaluate the success of the interaction within the process.



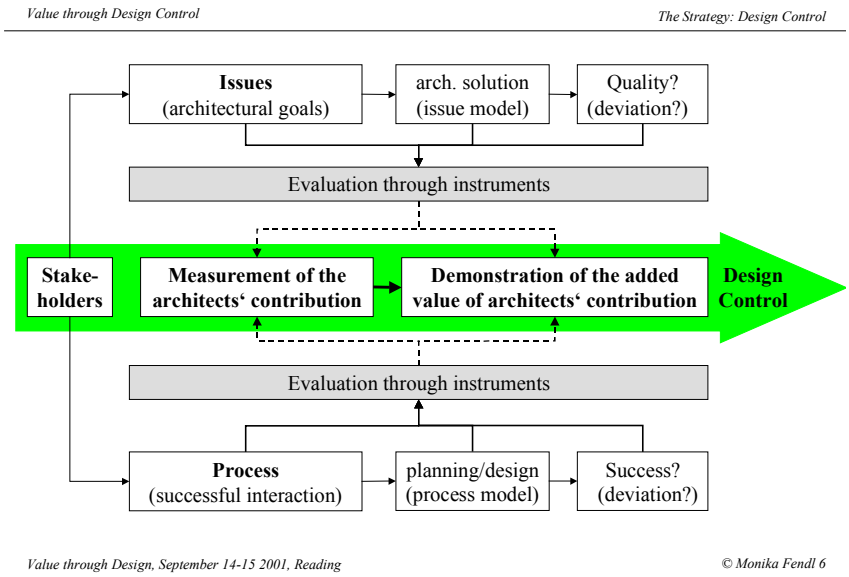
Using the *stakeholder model* as well as the *issue model* and the *process model*, it becomes possible to develop instruments for measuring and demonstrating the added value through the architects' contribution if they are using the following strategy called design control.

The strategy "design control"

Up to now, the approach was very theoretical. Let me try to be a little bit more practical now:

The question is, how to *link* all these aspects and models mentioned above and how to use them as a suitable instrument to support measurement and demonstration of the added value of the architects' contribution. The solution for that is a specific procedure, a strategy, that I call **design control**.

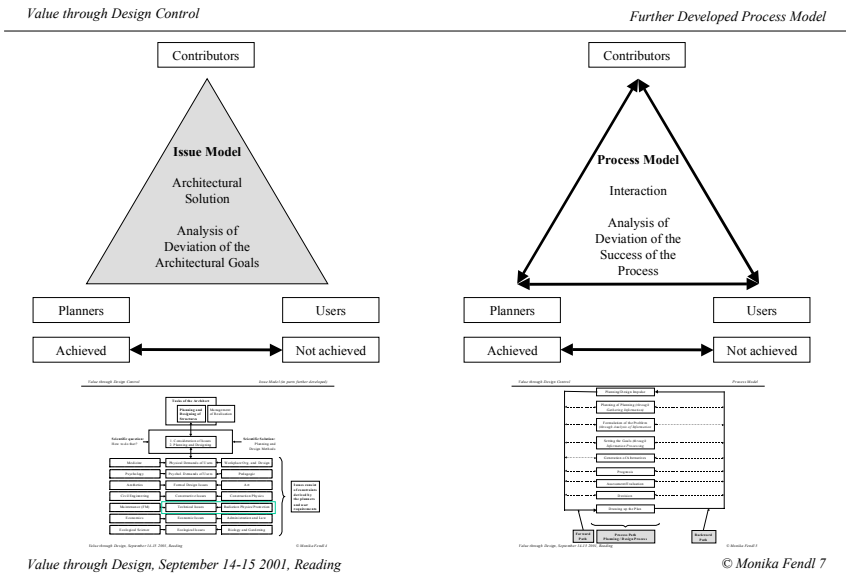
The general approach to design control is shown in the following chart:



Design control is based on and has to be done by the stakeholders from the very beginning of the process. They use *issues* (the architectural goals) to develop the *issue model* and therefore the architectural solution and in the end the evaluation of the quality in terms of its deviation. In addition, they use the *process model* to follow a procedure and to evaluate the procedure in terms of its success in the end. Through this evaluation, measurement and demonstration of the added value of the architects' contribution will be possible. In addition, by continuously controlling the whole planning and design process from the very beginning, it is possible

- to avoid planning and design mistakes,
- to remember all important aspects and issues, and
- to be therefore enabled to develop a goal-oriented solution.

But how does *design control* work in general?



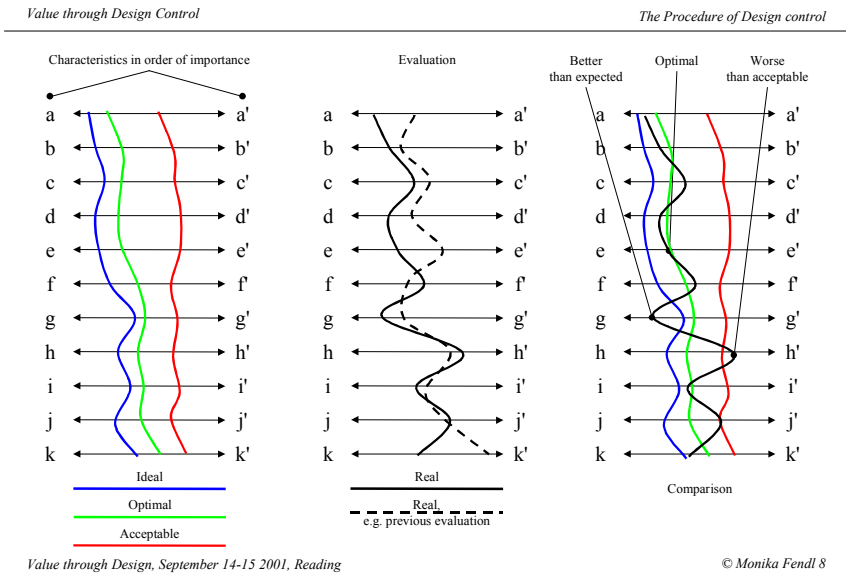
Design control is based on the three models as mentioned above linked with interview techniques. The above chart shows that contributors, planners, and users are asked for their opinion about the issues and finally the quality architectural solution. They use a **polarity profile** (achieved-not achieved) to formulate their estimation. In addition, contributors, planners, and users, are asked to judge the interactive process using the process model. For that, also the *polarity profile* is helpful.

Design control is an approach to control the *previously elaborated steps* with the goal to use that information for the *future steps*. Therefore, design control is a *future-oriented strategy*. In addition, *design control* confirms the planners to re-do steps already done if their results turned out as insufficient. *Design control* therefore helps to develop issues as well as evaluating the *architectural solution*. In addition, it helps to carry out the *planning and design process* and to evaluate it, too.

For the success of this strategy called design control, it is fundamental to use it

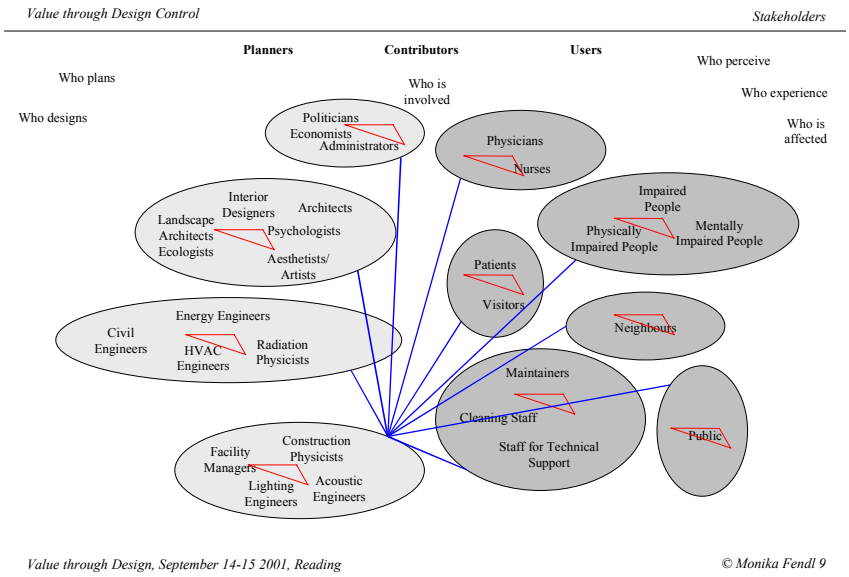
- from the very beginning,
- continuously through the whole planning and design procedure, and
- up to the very end of the process.

How does *design control* work practically? The following chart gives a brief overview over the strategy:



In a first step, necessary *characteristics* concerning the issues and the process are to be identified and put in an *order of importance*. Therefore, a *polarity profile* with **opposite descriptions** *(e.g. a-a')* is used. Then, the **ideal, optimal,** and **acceptable level** is to be laid down. The *evaluation* in terms of the quality of the issues and the success of the interactive process is done by the stakeholders, respectively the users and the planners. This evaluation has to be done from the very beginning, continuously, and of course to the very end as mentioned above. Because of changes of the architectural solution during the process and of the process itself (see real (actual) versus previous evaluation), the **real** (achieved) **level** will show this in its course and will therefore measure and demonstrate the changes. Finally, the **comparison** of the *ideal, optimal, and acceptable level* with the *real level* of performance of the architectural solution or the *real level* of the success of the interactive process is a way to measure and to demonstrate the added value of the architects' contribution within the planning / design process. In addition, changes during the process are also visualised.

The evaluation is to be done by interviewing the stakeholders. Each stakeholder is to be asked about his/her opinion in terms of the quality of the issues and the success of the process. These estimations can be visualised individually or group-wise.

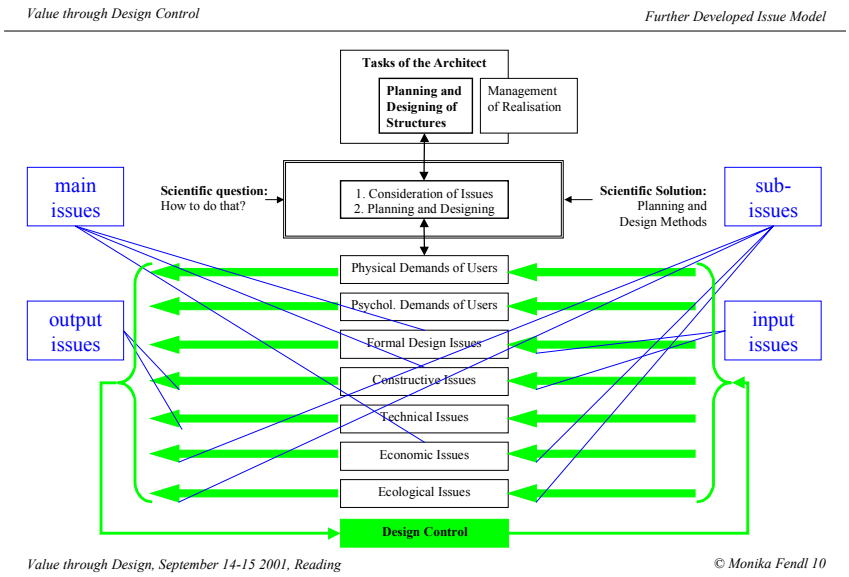


Design control using the issue model

Design control using the issue model

The following chapter will show how the strategy *design control* uses the *issue model.*

Each named *main issue* is developed furthermore into **sub-issues** depending on the kind of planning and design object. These sub-issues are called **output issue** because they are derived from the *main issues* through gathering from and controlling information by the stakeholders within a first step in the planning / design process. They have to be evaluated again, to be developed furthermore, and to be investigated in more detail. These *output issues* are in turn used as **input issues** that develop and control again the *main issues*. These input issues are therefore the basis for the next generation of *output issues* and in the end for the development of the architectural solution.



Although this kind of *design control* is a simple **feed forward-feed back procedure**, it is a new development in design methods because previous methods recommend to gather information cyclically, but *they do not recommend to double-check the information they received and to use the information again as an input*. Investigation turned out that information gathered from future users of buildings were sometimes simply and objectively false, even without the awareness of the future users. They just misjudged the situation although they have experienced the situation before. It is therefore very important to double-check the information received and to use it again as an input. In addition, each issue, each information, is a possible stimulus for the planners' and designers' work in terms of activating their creativity! Therefore, *design control* is also a way to stimulate creativity.

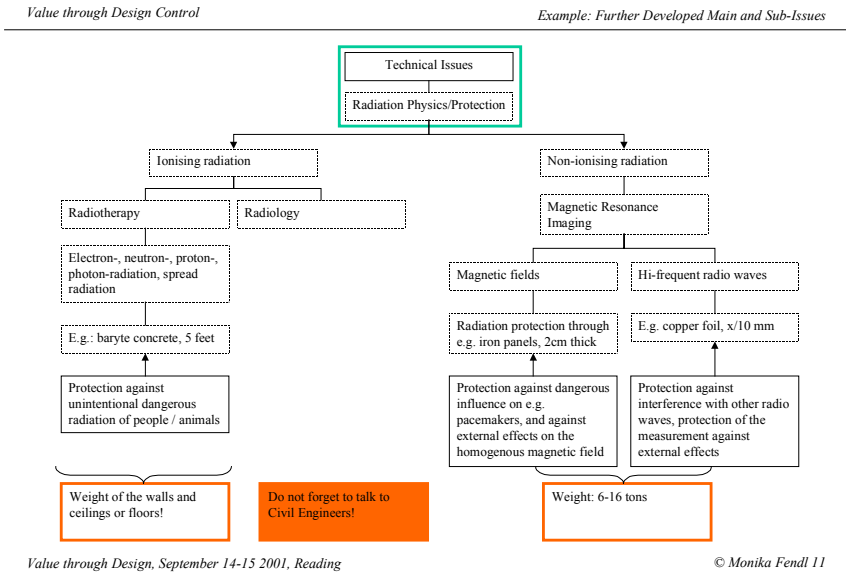
Because of the increasing precision of the issues, the *output issues* become more and more a suitable basis for the development of an architectural solution. By showing the difference between the *input issues* and the *output issues***,** the architect is able to measure his positive influence on the design process in terms of the issues. In addition, it is a way to demonstrate the added value through his contribution.

The two goals of design control,

- *development* of issues as a basis for the architectural solution and its *evaluation* in terms of its quality and
- development of a basis for the *measurement* and the *demonstration* of the added value of the architects' contribution

are fulfilled.

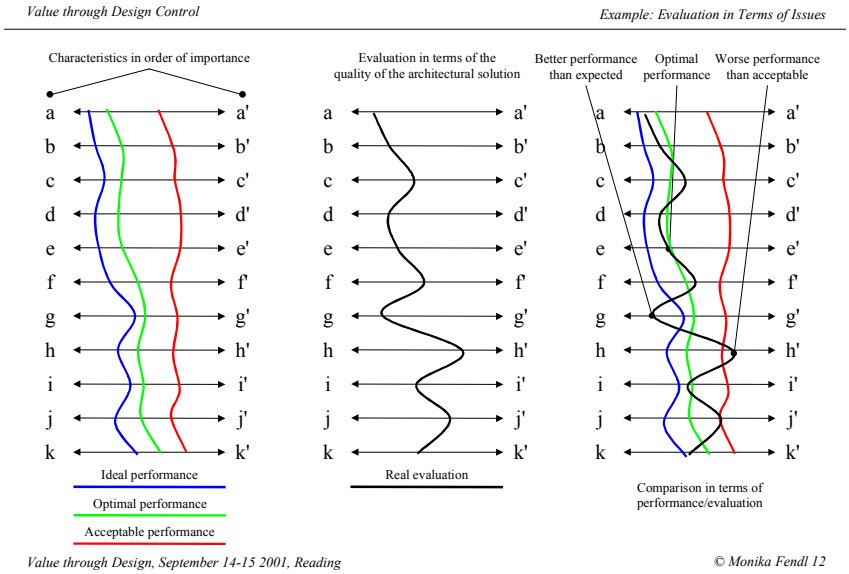
Example:



This chart shows one special subject covered by the general technical issue. It is about *radiation physics and radiation protection* in hospitals. It gives in a very simple way an idea about the complexity of that single issue. Of course, there are plenty of other issues that have to be taken into consideration when planning and designing a unit for radiotherapy, as e.g. physical and psychological demands as well as formal design issues, constructive, economical, and ecological issues. These issues have also to be developed through a multidisciplinary team of planners and users. Therefore, all these other aspects have to be identified and visualised in a similar chart. The charts are of help in the end because of an easier identification of the important issues. This way, it is easier for the planner and designer to simplify (= to make more clear) the complexity of the planning object, to take the issues into consideration, and finally to develop an architectural solution.

Evaluation of the issues using the issue model

The evaluation is to be done by a simple analysis of deviation between the *ideal, optimal, and acceptable performance* and the *real achieved performance*. This evaluation is to be done using the criteria, the main and sub-issues, gathered from the stakeholders, respectively the users and planners. Results may include that a user is complaining about a certain issue, and the planner possibly, too. They might agree or they might disagree. In any case, the results of this evaluation are to be recorded and therefore useful for the next similar project or even for the improvement of the existing situation. A possibility to record the results is again a *polarity profile*.



Design control using the process model

Design control using the process model

In the following chapter will show how the strategy *design control* uses the *process model.*

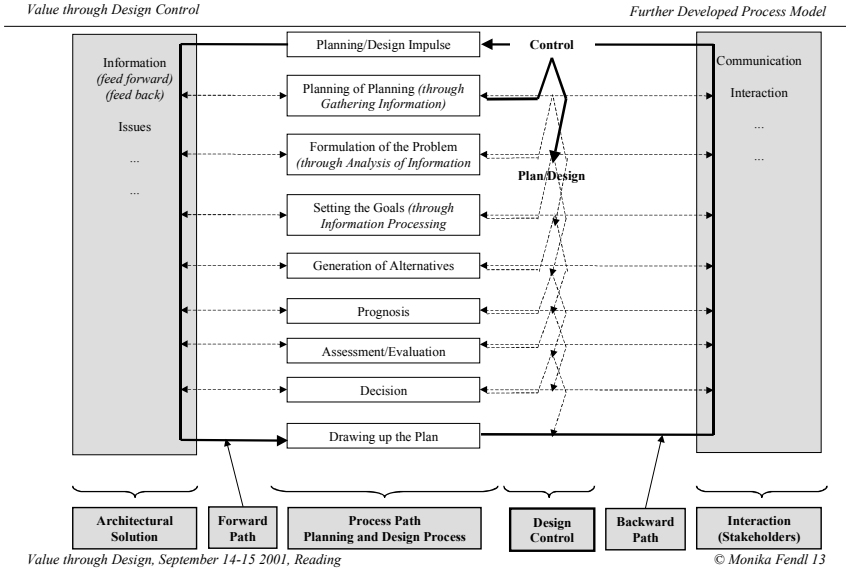
While plenty of other well-known models of the planning / design process intend to evaluate the architectural solution *cyclically* or even (only) after its *occupancy*, this model proposes to control *each step* and therefore the *whole process*. After finishing one step, it has to be evaluated. Aspects that have been taken into account during one step in an insufficient way have to be re-done.

In addition, future requirements / problems are to be identified and the problem can therefore be solved in *future steps*. Therefore, it is possible to compare the requirements and the achieved results of each step from the very beginning, continuously, and up to the very end. This allows to *influence the future proceeding "step by step"*. Consequently, architects get control over the whole planning and design process and can pass this information to the client. This will contribute to a clear and satisfying collaboration.

The goals

- to influence the future process as well as
- to enable architects to measure and to demonstrate

are fulfilled.



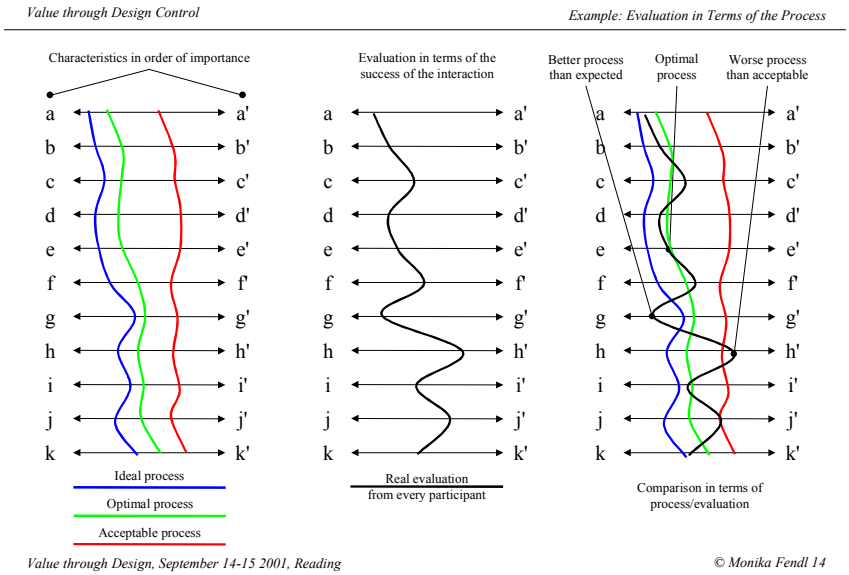
The approach recommends a repeated reflection after each step. Therefore, architects are enabled to examine the success of the step and to foresee arising mistakes. Consequently, architects may see that some additional work has to be done to avoid those mistakes. By recording all the information about the process – its lacks and its success – the architect is able to demonstrate the client the added values of his contribution, e.g. by pointing out the steps that should be investigated in further detail.

Example:

One example might be that a client causes a planning / design *impulse.* After having clarified the general of the planning / design project, the architects go on and gather information. The idea is that the architects only do the *first round* of gathering information which means that they only gather information that is important *in general* and is only meant to give the client and the architects and *overview over the problem*. When they have recorded this information, they go back to the previous *planning / design impulse* to examine whether that information supports the idea of the project or whether the information reveals that the project is not suitable for the site. In order to avoid such a basic mistakes, a repeated feed back and feed forward is highly recommended.

Evaluation of the process using the process model

The evaluation is again done by a simple analysis of deviation between the *ideal, optimal, and acceptable process* and the *real achieved success of the process*. This evaluation should be done by the stakeholders, respectively the users and planners using the criteria of the *process model*. A result may be that the planners are content with the process and think that they did every step very well, and that by contrast the users felt misunderstood or even unnoticed. In any case, the results of this evaluation are to be recorded again and therefore are useful for the next process or even can improve the current process. One possibility to record the results is again a polarity profile.



Conclusion: measurement and demonstration

This is to summarise the approach described above:

First of all, three models have to be developed:

- the model of stakeholders as a general basis (stakeholder-oriented approach),
- the issue model as a basis for the architectural solution and its evaluation through interviewing stakeholders, and
- the process model as a basis for the interactive procedure of planning and designing.

The strategy design control is a feed back-feed forward strategy and is to be used

- to develop main and sub-issues,
- to evaluate the issues again and again through interviewing the stakeholders,
- to follow a successful interactive process,
- to influence future steps of the procedure through evaluation of the previous ones (future-oriented approach), and
- to evaluate the process continuously through interviewing the stakeholders

By recording the results of the two evaluations by the stakeholders, architects are enabled to measure and to demonstrate the added value of the their contribution using polarity profiles. For a high quality of the architectural solution, continuous development and control of the issues are fundamental. Besides, for a successful interactive process the continuous control of and influence on the process is the required as well.

Outlook

Using this strategy linked with the three models, the planning and design process becomes more comprehensible and therefore acceptable for the stakeholders. In addition, its increased reliability, validity, and of course repeatability supports its usefulness. Through clarifying issues, the goal of any method, namely to improve results, is supported as well.

Monika Fendl, 1st June 2001

Technische Universität Dresden/Dresden University of Technology

Fakultät Architektur/Department of Architecture

Professur für Sozial- und Gesundheitsbauten/

Chair for the Architectural Design of Social Facilities and Healthcare Buildings

01062 Dresden, Germany

Phone ++49-351-463 34724 (++49-351-463 4724 until October 1 2001)

Fax ++49-351-463 37089 (++49-351-463 7089 until October 1 2001)

Web: www.tu-dresden.de/arige/sozialb

Contact: Monika.Fendl@web.de

HSSS AdminTools (c) 2001, last visited: Thu Aug 30 14:30:35 GMT+02:00 2001